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Eleven New Species of Caddisflies from Taiwan (Insecta: Trichoptera) **【Research report】**

臺灣產十一種毛翅目新種(昆蟲綱) **【研究報告】**

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Abstract

Eleven new species of caddisflies from Taiwan, representing 4 families, are described, illustrated and their taxonomic affinities indicated. These species include 3 Rhyacophilidae (*Rhyacophila coclearis* n. sp., *R. magnahamata* n. sp., and *R. madalensis* n. sp.), 6 Philopotamidae (*Chimarra lichiuensis* n. sp., *C. triangulata* n. sp., *C. wushikangensis* n. sp., *Dolophilodes minchiensis* n. sp., *D. cheni* n. sp., and *D. securis* n. sp.), 1 Xiphocentronidae (*Melanotrichia taiwanensis* n. sp.), and 1 Ecnomidae (*Ecnomus wulaina* n. sp.).

摘要

本文描繪4科11種毛翅目新種之雄蟲及雌蟲。其中3種為Rhyacophilidae (*Rhyacophila coclearis* n. sp., *R. magnahamata* n. sp., *R. madalensis* n. sp.)。6種為Philopotamidae (*Chimarra lichiuensis* n. sp., *C. triangulata* n. sp., *C. wushikangensis* n. sp., *Dolophilodes minchiensis* n. sp., *D. cheni* n. sp., *D. securis* n. sp.)。1種為Xiphocentronidae (*Melanotrichia taiwanensis* n. sp.) 及1種Ecnomidae (*Ecnomus wulaina* n. sp.)。

Key words: taxonomy, new species, Taiwan, Trichoptera

關鍵詞: 分類、新種、臺灣、毛翅目。

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Eleven New Species of Caddisflies from Taiwan (Insecta: Trichoptera)

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ABSTRACT

Eleven new species of caddisflies from Taiwan, representing 4 families, are described, illustrated and their taxonomic affinities indicated. These species include 3 Rhyacophilidae (*Rhyacophila coclearis* n. sp., *R. magnahamata* n. sp., and *R. madalensis* n. sp.), 6 Philopotamidae (*Chimarra lichiuensis* n. sp., *C. triangulata* n. sp., *C. wushikangensis* n. sp., *Dolophilodes minchiensis* n. sp., *D. cheni* n. sp., and *D. securis* n. sp.), 1 Xiphocentronidae (*Melanotrichia taiwanensis* n. sp.), and 1 Ecnomidae (*Ecnomus wulaina* n. sp.).

Key words: taxonomy, new species, Taiwan, Trichoptera

Introduction

The Trichoptera of Taiwan were successively reported by Ulmer (1911, 1913, 1927), Tsuda (1940, 1942), Ross (1956) and Kobayashi (1987). There are still many species which have yet to be described. Here 11 new species are added to the Taiwanese caddisfly fauna. All specimens were collected from 1991 to 1996 by the senior author, unless indicated otherwise. The insects were captured by light traps or by sweeping along riversides. Specimens were preserved in 75% alcohol. The abdomens of both male and female caddisflies were cleared in 10% potassium hydroxide (KOH) at 90°C for 15 minutes, and then examined and drawn in glycerin under a stereomicroscope. The holotypes and some paratypes will be deposited in the National Museum of Natural Science of Taiwan (NMNS); other paratypes are deposited in the Department of Biology, Tunghai Univer-

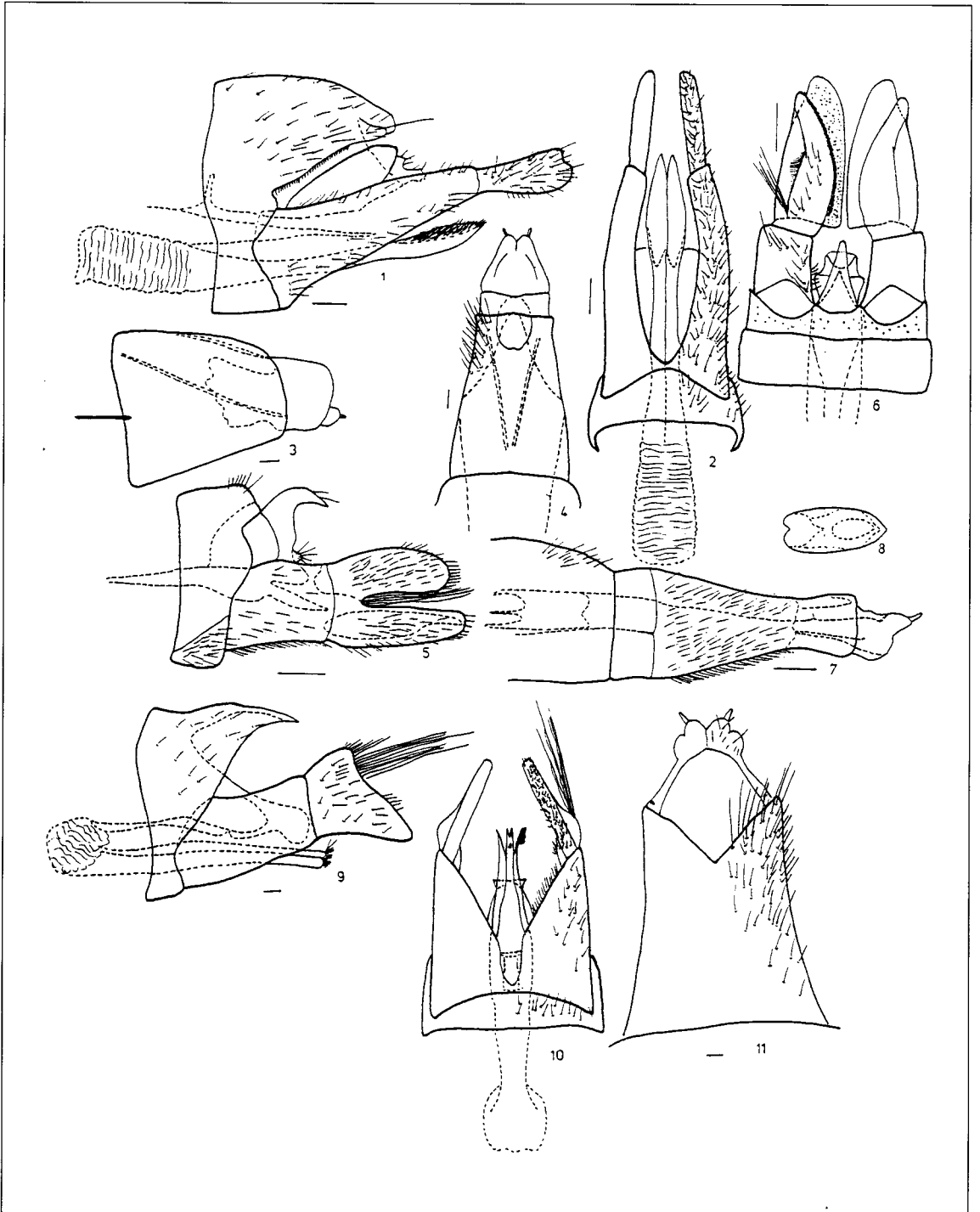
sity, Taiwan (BTHU).

Descriptions of New Species FAMILY RHYACOPHILIDAE

Rhyacophila coclearis n. sp. (Figs. 1-4)

Body yellowish brown, ventrad pale, ca. 7.8 mm long. Antenna about as long as forewing, segments rectangular, with wide dark setal ring. Maxillary palpi basal segment shortest and bulbous, long black setae present at first 2 segments; labial palpi short. Wings yellowish brown, covered with short setae. Forewing dark spotted, ca. 9.2 mm long, all apical forks present, r-m and m-cu crossveins indistinct, anal vein 3A meeting 2A then joining 1A together. Hindwing ca. 6.8 mm long, with short sc-r1 crossvein, f4 absent, anal veins joining at base.

Male genitalia: Segment IX round, dorsum broad. Tergite X stout and apex round in lateral view, posterior subdivided in dorsal view, with elongated and



Figs. 1-11. *Rhyacophila coclearis* n. sp., 1, male genitalia, lateral; 2, same, ventral; 3, female genitalia, lateral; 4, same, ventral. *Rhyacophila magnahamata* n. sp., 5, male genitalia, lateral; 6, same, dorsal; 7, female genitalia, lateral; 8, spermathecal sclerite, ventral. *Rhyacophila madalensis* n. sp., 9, male genitalia, lateral; 10, same, ventral; 11, female genitalia, dorsal. *The scale lines on the figures represent 0.1mm.

extended ventral sagittate process. Inferior appendage elongated, basal segment rectangular and base slightly broader, apical segment shorter, apex slightly concave. Paramere branched, elongated, apex spoon-like, densely covered with dark brown setae. Phallus short and pointed apically.

Female genitalia: Segment VIII well developed, tergite posterior subdivided and anterior broad, sternite rectangular and posterior subdivided, with 2 longitudinal grooves aligned. Segment IX small, fused with X and XI; X and XI membranous, X swollen laterally forming bulbous process, XI with posterior tubercle process. Spermathecal sclerite base round, apex with pair of lateral processes.

Type material: Holotype ♂, ILAN: Minchi, 1200m, 16-VIII-1995 (NMNS); Paratypes 4♂4♀, same data as holotype (NMNS); ILAN: Rerntzer Spring, 460m, 3♂3♀, 24-X-1995 (BTHU); KAOHSIUNG: Weirjein Stream, 1200m, 5♂4♀, 11-XI-1995 (NMNS).

Other material examined: NANTOU: Lushan, 1200m, 2♂, 10-II-1993; Tunguang, 1♀, 18-VIII-1995. Y. L. Yang; TAICHUNG: Wushikang, 400m, 5♂2♀, 3-VI-1995; Tachia Stream, 600m, 1♂, 23-X-1994; TAIPEI: Manyuehyuan, 300m, 1♂1♀, 4-VIII-1995.

Etymology: Latin: *coclearis*, spoon.

Note: The round apex of the inferior appendage, the shape of the IX tergite and segment X differentiate this new species from other species in this genus.

Rhyacophila magnahamata n. sp. (Figs. 5-8)

Body dark to dark brown, ca. 6.6 mm long. Antenna shorter than forewing. All setal warts covered with long dark setae. Wings brown, with dark area near R1 cell, and lighter in female. Forewing ca. 7.3 mm long, R1 bibranched, with short r1-r2 crossvein, all apical forks present, f1 and f2 long, r-m and m-cu crossveins indistinct, anal vein 3A meeting 2A then joining 1A. Hindwing ca. 5.7 mm long, r1-

r2 crossvein present, f4 absent, anal vein 2A separated from 1A. Female abdominal segment VII with small sclerotic process.

Male genitalia: Sternite VIII with small triangular sclerotic process. Segment IX small, sclerotic, dorsad broad. X dorsal plate hook-like and curved ventrad in lateral view. Inferior appendage stout, basal segment rectangular, covered with short setae, apical segment forked in lateral view. Inner surface of ventral branch densely covered with brown, short, thick setae. Parameres paired and blade-like. Phallus small, rectangular.

Female genitalia: Segment VIII narrow, dark brown, densely covered with long dark setae. IX segment short and pale. X segment membranous, fused with XI, ventrad slightly swollen. XI membranous with pair of tubercles. Spermathecal sclerite elliptical.

Type material: Holotype ♂, TAIPEI: Hapern, 400m, 23-X-1995 (NMNS); Paratypes 1♀, same data as holotype (NMNS); PINTUNG: Nanrernshan, 100m, 1♀, 13-IX-1994, Y. T. Hwang (NMNS).

Etymology: Latin: *magnus*, giant, big; *hamatus*, hook.

Note: The shape of segment X and the inferior appendage differentiate this new species from other species in this genus.

Rhyacophila madalensis n. sp. (Figs. 9-11)

Body yellowish brown, ca. 10.1 mm long. Antenna shorter than forewing. Ocelli large. Forewing brown, ca. 12.7 mm long, male covered with yellow spots, fewer in female, all apical forks present, f1 and f2 long, discoidal, thyridial and median cells open; m-cu crossvein indistinct; anal veins joined together. Hindwing ca. 10.7 mm long, pale brown, slightly darker near costal margin, f4 absent; r-m crossvein indistinct, anal vein 1A joins 2A basally.

Male genitalia: Sternite VIII with small sclerotic triangular process. Tergite I-VIII with long setae, sternite with a meso-

posterior sclerotic ring. IX extended dorsad. X dorsal plate large, subtriangular in dorsal view, apex slightly divided, hook-like in lateral view, slightly curved ventrad. Inferior appendage stout, basal segment rectangular, base broad, apical segment base rectangular, posterior with long black setae, apex triangular, sloping ventrad, surface concave, densely covered with short setae; inner surface of joint with small lobe process and dense short dark setae. Paramere paired, elongated and slender, apex flat with dense dark setae. Phallus elongated, base broad, constricted to slender, apex subdivided.

Female genitalia: Segment VIII large, base broad, tergite posterior triangular truncated, sternite subdivided, with 2 grooves, covered with short setae. Tergite IX and sternite fused with X tergite and sternite, membranous. X with pair of membranous tubercles. Spermathecal sclerite base round, apex extended laterally, slender and pointed in dorsal view, boat-like in lateral view, apex curved dorsad.

Type material: Holotype ♂, MIAOLI: Madala Stream, 1730m, 9-XII-1991 (NMNS); Paratypes 1♀, same data as holotype (NMNS); HUALIAN: Hohwan-shan, 3100m, 1♂ 1♀, 14-X-1995 (BTHU); KAOHSIUNG: Weirjin Stream, 1200m, 2♂, 11-XI-1995 (NMNS).

Etymology: Latinization: *madalensis*, from Madala Stream.

Note: This species is similar to *R. dumogana* Neboiss & Botosaneanu (1988) from Sulawesi, but differs in the shape of the inferior appendage and segment X.

FAMILY PHILOPOTAMIDAE

Chimarra lichiuensis n. sp. (Figs. 12-16)

Body dark, ca. 4.0 mm long. Antenna slightly shorter than forewing, scape bulbous, other segments cylindrical, covered with dark setae. Wings covered with dense dark setae; forewing ca. 5.4 mm long, with metallic shine, discoidal, thyridial and median cells open, R vein

curved before start of discoidal cell, f4 absent; hindwing ca. 4.6mm long, venation similar to forewing. Spur formula 1-4-4, legs and spurs densely covered with dark setae.

Male genitalia: Segment VIII small, mesolateral concave, tergite VIII anterior concave, posterior extended, hook-like in lateral view; sternite small. Segment IX small, post-lateral margin extended, with longitudinal crista on middle of sternite. Preanal appendage small, round. Intermediate appendage leaf shaped, and extended ventrad, tapering distally. Inferior appendage stout, rectangular, apex pointed, slightly concave at inner margin. Phallosome tube-like, slender; endotheca membranous, with 4 long black spines on dorsum.

Female genitalia: Segment VIII large, sternite with small sclerotic process. Segment IX small, sternite divided, forming 2 rectangular sclerites. Segment X round, fused with XI; XI with pair of membranous tubercles.

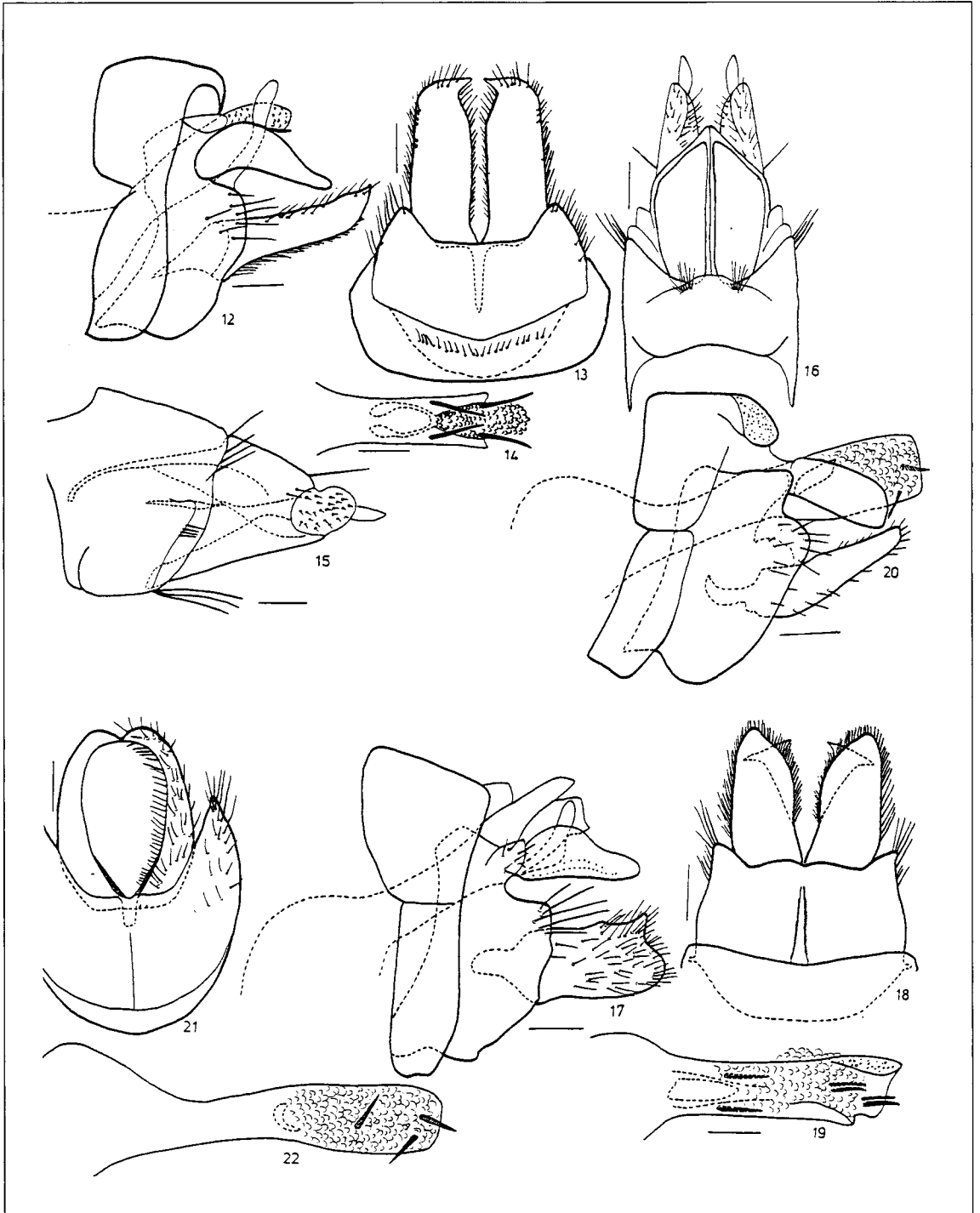
Type material: Holotype ♂, TAITUNG: Lichiu, 150m, 21-XI-1995 (NMNS); Paratypes 10♂ 8♀, same data as holotype (NMNS); ILAN: Wufengchi, 150m, 1♂ 3♀, 25-X-1995 (BTHU); Rerntzer Spring, 460m, 1♂, 24-X-1995 (NMNS); TAICHUNG: Wushikang, 460m, 2♂, 3-VI-1995 (NMNS); TAIPEI: Hapern, 400m, 8♂ 2♀, 23-X-1994 (BTHU).

Other material examined: CHIAYI: Reili, 1♂, 31-III-1996; KAOHSIUNG: Lanya Bridge, 1250m, 2♂, 11-XI-1995; Bulao Spring, 300m, 4♂, 6-IV-1995; Weirjin Stream, 1200m, 1♂, 11-XI-1995; TAICHUNG: Shijiau Forest, 400m, 2♂, 26-VII-1995; TAIPEI: Wulai, 200m, 1♂, 8-V-1994.

Etymology: Latinization: *lichiuensis*, from Lichiu.

Note: This species is very similar to *C. tsudai* Ross (1956), but the shape of the inner margin of the inferior appendage and phallus are different.

Chimarra triangulata n. sp. (Figs. 17-19)



Figs. 12-22. *Chimarra lichiuensis* n. sp., 12, male genitalia, lateral; 13, same, ventral; 14, phallus, dorsal; 15, female genitalia, lateral; 16, same, ventral. *Chimarra triangulata* n. sp., 17, male genitalia, lateral; 18, same, dorsal; 19, phallus, lateral. *Chimarra wushikangensis* n. sp., 20, male genitalia, lateral; 21, same, ventral; 22, phallus, lateral. *The scale lines on the figures represent 0.1mm.

Body dark, ca. 6.3 mm long. Antenna shorter than forewing. Forewing ca. 7.1 mm long, humeral crossvein at middle of Sc, f 4 absent, f1 long, starting before end of discoidal cell. Hindwing ca. 5.6 mm long, R1 somewhat indistinct, discoidal cell small and triangular, anal veins looped. Spur formula 1-4-4.

Male genitalia: Tergite VIII broader than sternite VIII, anterior broad, truncated and subtriangular. Sternite IX with longitudinal groove, apex extended laterally. Intermediate appendage extended dorsad and stout. Preanal appendage finger-like, apex truncated. X segment small, base swollen, apex rounded. Inferior appendage stout, apex truncated, with hook-like process, inner margin sloped outward. Phallosome rod-like, endotheca membranous, with 6 stout black spines.

Female: Unknown.

Type material: Holotype ♂, TAICHUNG, 45 km along the Central Cross-Island Highway, 850 m, 2-III-1996 (NMNS); Paratypes 6 ♂, same data as holotype (NMNS).

Etymology: Latin: *triangulus*, triangular.

Note: The shape of the inferior appendage of this new species is similar to *C. moselyi* Ross (1956) and *C. spitzeri* Malicky (1993), but can be distinguished by the shape of tergite IX, segment X and preanal appendage.

Chimarra wushikangensis n. sp. (Figs. 20-22)

Body dark brown, ca. 4.2 mm long. Antenna shorter than forewing. Forewing ca. 5.7 mm long, discoidal cell closed by indistinct crossvein. Hindwing ca. 4.9 mm long, discoidal cell small and triangular, f 4 absent, f1 starting before r2-r3 crossvein. Spur formula 1-4-4. Claws of front leg long.

Male genitalia: Segment VII narrowed laterally, tergite broader posteriorly and rectangular, sternite small. Segment IX ventrad broad, sternite anterior extended

and pointed laterally. Preanal appendage slender. Intermediate appendage rectangular and extended ventrad in lateral view, dorsum divided, with pair of hook-like processes. Inferior appendage slender, blade-like, apex curved and pointed. Phallosome absent, endotheca elongated, base swollen, apex membranous, with 3 long black spines in lateral view.

Female: Unknown.

Type material: Holotype ♂, TAICHUNG: Wushikang, 460 m, 3-VI-1995 (NMNS); Paratype 1 ♂, same data as holotype (NMNS).

Etymology: Latinization: *wushikangensis*, from Wushikang.

Note: The shape of the inferior appendage is similar to *C. mlabrionum* Chantaramongkol & Malicky (1991), but the shapes of tergite IX and segment X are different.

Dolophilodes (Kisaura) minchiensis n. sp. (Figs. 23-25)

Body yellowish brown, ca. 5.6 mm long. Antenna shorter than forewing. Wings loosely covered with setae, metallic shine, with dark area created by dense setae between apex of Sc and R1, especially on hindwing; forewing ca. 5.4 mm long, with some indistinct dark spots, discoidal cell triangular, all apical forks present, f1 small, anal vein 3A meets 2A then 1A, forming loop; hindwing ca. 4.5 mm long, discoidal cell triangular, f4 absent.

Male genitalia: Tergite VIII posterior slightly truncated, sternite slightly extended posteriorly. Segment IX sclerotized, broad laterally, anterior of sternite triangularly truncate; cercus paired and rod-like, mesal process of cercus slender, blade-like, apex slightly curved, reaching joint of inferior appendage, segment X dorsal plate blade-like, as long as process of cercus. Base segment of inferior appendage short and stout, subtriangular, with small rectangular truncated posterior margin, apex segment elongated and

dorsum extended, inner surface densely covered with dark brush-like setae. Phallus rod-like.

Female genitalia: Segment VIII broad anteriorly, tergite extended posteriorly, sternite small. Segment IX narrow, short in lateral view, sternite posterior subdivided. Segment X small, ventrad broad, membranous, with pair of membranous tubercles.

Type material: Holotype ♂, ILAN: Minchi, 1200m, 16-VIII-1995 (NMNS); Paratypes ILAN: Rerntzer Spring, 450m, 1♂, 2-V-1994 (NMNS); 1♂, 24-X-1995 (NMNS); TAICHUNG: Wushikang, 460m, 1♂, 3-VI-1995 (BTHU); TAITUNG: Lichiu, 150m, 9♂, 21-XI-1995 (BTHU).

Etymology: Latinization: *minchiensis*, from Minchi.

Note: This species is similar to *D. obrussa* Ross (1956), but differs in the shapes of the preanal appendage, cercus and apical segment of the inferior appendage.

Dolophilodes cheni n. sp. (Fig. 26-30)

Body yellowish brown, ca. 4.2 mm long. Antenna shorter than forewing. Eyes large, surface covered with thin setae. Forewing ca. 4.9 mm long, with some pale spots; all apical forks present, f 1 small and with a long stalk; discoidal, median and thyridial cells triangular. Hindwing ca. 4.1 mm long, discoidal, thyridial and median cells open; f1 absent.

Male genitalia: Sternite VII and VIII with small triangular processes. Segment IX dorsad broad. Preanal appendage rod-like. Segment X slender and apex curved dorsad in lateral view, subtriangular and subdivided in dorsal view. Inferior appendage 2 segmented, about equal length, basal segment rectangular, apical segment with brush-like setae on inner margin of apex. Phallosome elongated and stout, arising from middle of segment V, posterior membranous, with some black spines.

Female genitalia: Sternite VIII with stout process, tergite posterior extended dorsad. Segment IX small and anterior extending into segment VIII, ventrad broader. Sternites X and IX fused and membranous, Tergite XI membranous and divided forming 2 bulbous processes, each with a small tubercle process.

Type material: Holotype ♂, TAICHUNG: Wushikang, 460m, 3-VI-1995 (NMNS).

Etymology: Latinization, *cheni*, named after Dr. Eric Y. Chen.

Notes: This species is very similar to *Wormaldia ulmeri* Ross (1956) in the shape of the male genitalia; but this species has a broader basal segment of the inferior appendage and a longer segment X.

Dolophilodes securis n. sp. (Figs. 31, 32)

Body yellowish brown, ca. 7.9 mm long. Antenna shorter than forewing. Forewing 10.1 mm long, with yellowish spots, distal costal margin with dark area.

Male genitalia: Tergite VIII broader than sternite, sternite with small triangular sclerotized process. Tergite IX anterior truncated, sternite extended laterally. Preanal appendage short and apex swollen. Intermediate appendage small and rod-like. Basal segment of inferior appendage stout and rectangular, apical segment slightly slender and both equal in length, lower margin of apex densely covered with short dark setae. Phallus short, ax-shaped.

Female: Unknown.

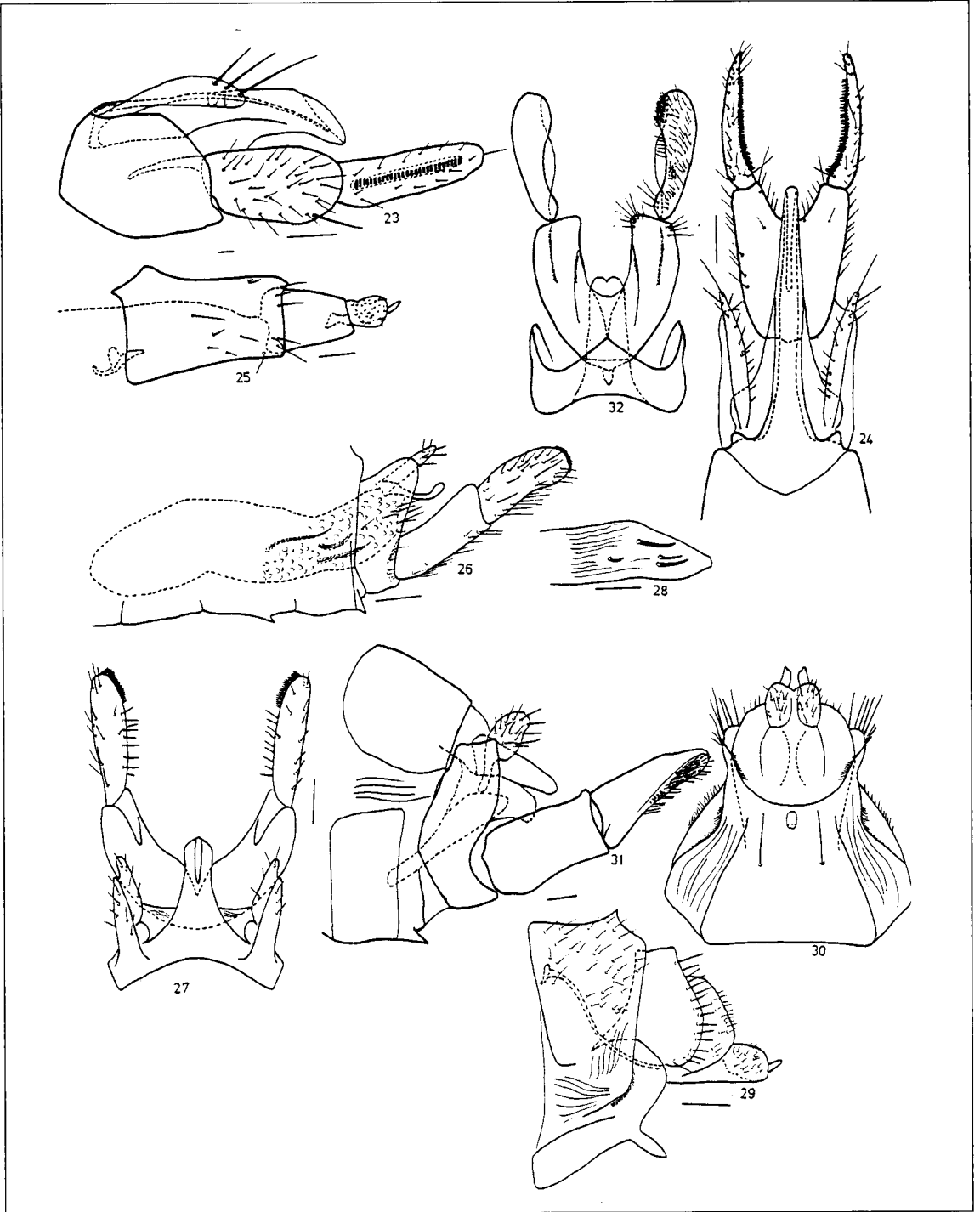
Type material: Holotype ♂, NANTOU: Peitunyeinshan, 1950m, 16-III-1996 (NMNS).

Etymology: Latin, *securis*, ax.

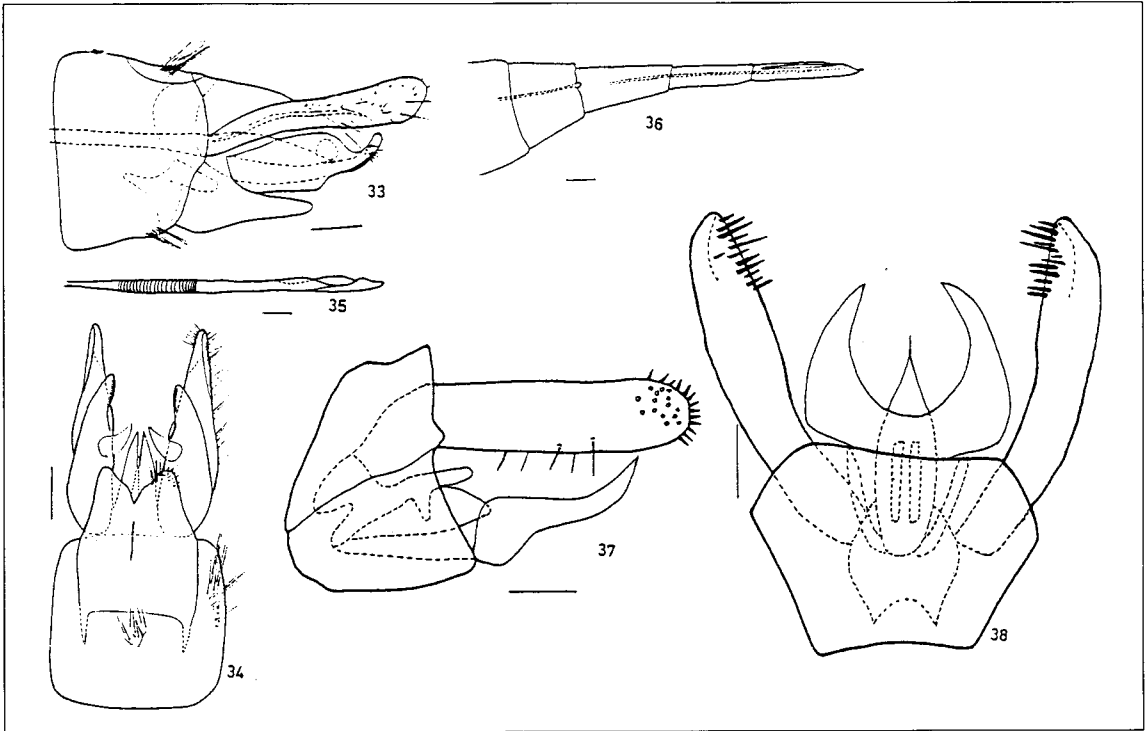
Note: The IX tergite and phallus of this species have a special shape and it differs from other known species in this genus.

FAMILY XIPOCENTRONIDAE

Melanotrichia taiwanensis n. sp. (Figs. 33-



Figs. 23-32. *Dolophilodes minchiensis* n. sp., 23, male genitalia, lateral; 24, same, dorsal; 25, female genitalia, lateral; *Dolophilodes cheni* n. sp., 26, same, male genitalia, lateral; 27, same, dorsal; 28, apex of phallus, lateral; 29, female genitalia, lateral; 30, same, ventral. *Dolophilodes securis* n. sp., 31, male genitalia; 32, same, dorsal. *The scale lines on the figures represent 0.1 mm.



Figs. 33-38. *Melanotrichia taiwanensis* n. sp., 33, male genitalia, lateral; 34, same, ventral; 35, phallus, lateral; 36, female genitalia, lateral. *Ecnomus wulaina* n. sp., 37, male genitalia, lateral; 38, same, ventral. *The scale lines on the figures represent 0.1mm.

36)

Body brown or dark brown, ca. 4.5 mm long. Antenna shorter than forewing. Head with pair of large, elliptical posterior setae warts. Pronotum with 2 pairs of setae warts, median warts small and oval. Mesonotum setal warts large and rectangular. Wings slender and truncated apically, covered with few setae. Forewing ca. 5.1mm long, Sc short but stout, discoidal cell pentagonal, f2 and f4 present. Hindwing ca. 4.8mm long, costal portion with stout setae aligned anteriorly, ridged at midwing, venation reduced, apex tapering. Legs with black setae.

Male genitalia: Segment VIII well developed, round. Tergite IX small and bilobed, sternite apex branched, subtriangular and tapering distally in lateral view. Segment X elongated and triangular, subdivided, apex dorsum with small

membranous finger-like process. Preanal appendage elongated and stout. Inferior appendage stout, broader at base, with stout hook-like process near middle, thick black spines aligned on inner margin of apex. Phallus long and slender, starting from segment VI, apex membranous.

Female genitalia: VIII segment slender, anterior broad, tapering distally. IX slender and narrow. X slender, apex dorsad truncated, with paired tubercles.

Type material: Holotype ♂, TAICHUNG: Wuling Stream, 2200m, 18-VII-1988, Y. E. Chen (NMNS); Paratypes 4 ♂ 3 ♀, same data as holotype (NMNS); Hsueshan Creek, 2300m, 2 ♂ 2 ♀, 18-VII-1988. Y. E. Chen (NMNS); Shiwarn Stream, 700m, 1 ♂ 1 ♀, 21-I-1996 (BTHU).

Etymology: Latinization: *taiwanensis*, from Taiwan.

Note: This species resembles other

species in this genus, e. g., *M. singularis* Ulmer (1906) and *M. acclivopennis* (Hwang, 1957), but differs greatly in the shape of the inferior appendage and IX sternite.

FAMILY ECNOMIDAE

Enomus wulaina n. sp. (Figs. 37,38)

Body light yellowish brown, ca. 4.3 mm long. Antenna longer than forewing. Forewing ca. 4.7 mm long, all forks present, discoidal cell small, median and thyridial cells open. Hindwing ca. 3.8 mm long, venation reduced, f2 present, discoidal, median and thyridial cell open, with only 1 anal vein, M3+4 separated from M1+2 but joining Cu1. Mid and hind legs long, especially tibia and femur.

Male genitalia: Segment IX narrow, tergite rounded, apex with tiny triangular process, sternite rectangular. Superior appendage elongated, rectangular, apex with stout black spines. Inferior appendage blade-shaped, apex curved upward and taper. Phallus short, apex pointed.

Female: Unknown.

Type material: Holotype ♂, TAIPEI: Wulai, 200m, 8-V-1994 (NMNS); Paratypes 1 ♂, same data as holotype (MHNS); NANTOU: Hueihsun, 1 ♂, 3-IV-1993 (NMNS); PINTUNG: Nanzen-shan, 100m, 1 ♂, 13-IX-1994 (BTHU).

Eymology: Latinization: *wulaina*, from Wulai.

Note: This species resembles other species in this genus, e. g., *E. russellius* Neboiss, (1977) and *E. tillyardi* Mosely (1953), but differs greatly in the shape of the inferior appendage and IX sternite.

Acknowledgments

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臺灣產十一種毛翅目新種(昆蟲綱)

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摘 要

本文描繪4科11種毛翅目新種之雄蟲及雌蟲,其中3種為Rhyacophilidae (*Rhyacophila coclcrearis* n. sp., *R. magnahamata* n. sp., *R. madalensis* n. sp.), 6種為Philopotamidae (*Chimarra lichiuensis* n. sp., *C. triangulata* n. sp., *C. wushikangensis* n. sp., *Dolophilodes minchiensis* n. sp., *D. cheni* n. sp., *D. securis* n. sp.), 1種為Xiphocentronidae (*Melanotrichia taiwanensis* n. sp.) 及1種Ecnomidae (*Ecnomus wulaina* n. sp.).

關鍵詞: 分類、新種、臺灣、毛翅目